9/26 Notes – Relations and Functions

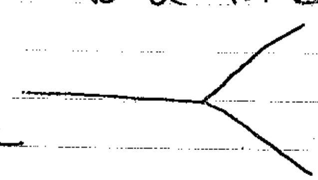
* Ordered Pair: a point (x, y)

  Domain ↗ ↖ Range

* Relation: a set of ordered pairs

* Function: a relation where every element in the domain is paired with <u>exactly</u> <u>one</u> element in the range

  ⇒ Walking, you (Domain) come to a fork in the road.



You can only take one fork (Range).

More than one person can take the

2 tests to determine if it's a function

① Vertical line test

② Mapping Diagram

Ex: $\{(-1,2), (-2,6), (3,5), (4,1)\}$

X Domain: $\{-2, -1, 3, 4\}$

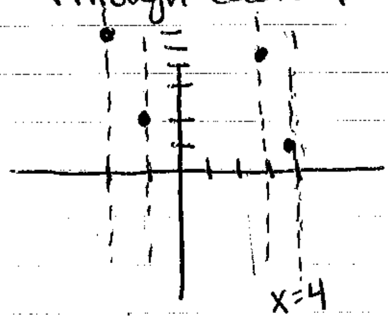
Y Range: $\{1, 2, 5, 6\}$

* write in order from least to greatest, do NOT write repeats

Test 1 - Vertical Line

A. Plot points

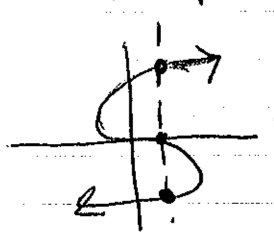
B. Imagine a vertical line through each point



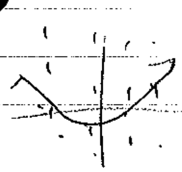
yes, a function!

* If two or more points on a line → NOT a function

* Only one pt. per line → IS function



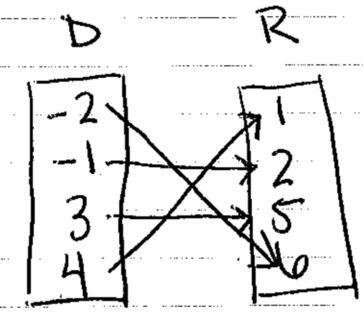
Not a function



Test 2 - Mapping Diagram

A. Find D, R

B. Draw arrows from D to R to connect the x from pt. to its y



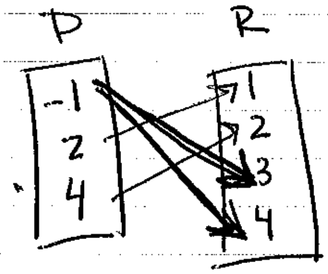
yes, a function!

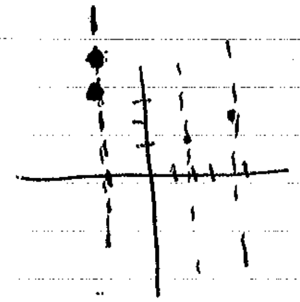
* If there's more than one arrow from any # in D, NOT a function

* If one arrow from each # in D, yes it is a function

Is it a function?

Ex 2: $\{(-1,3), (4,2), (2,1), (-1,4)\}$





Not a function

Not a function

Evaluating Functions

- Plug in + solve

"f of x" $y = f(x) = 5x - 2$

$f(2) = 5(2) - 2$

$\boxed{f(2) = 8}$

y-value when $x = 2$

(2, 8) on graph

"f of 2" means, evaluate when $x = 2$

$f(x) \quad 5x - 2$

Ex 2: $f(-3) = 5(-3) - 2$

$f(-3) = -17$ STOP Here!

When $x = -3$, $y = -17$

Ex 3: $f(x) = 5x - 2$

$f(4c) = 5(4c) - 2$

$f(4c) = \boxed{20c - 2}$

Ex 4: $g(x) = x^2 + 2x + 3$

Find $g(2a) = (2a)^2 + 2(2a) + 3$

$g(2a) = 4a^2 + 4a + 3$

Notes 9/27 - Combining Functions

$f(x) = x-5$ $\qquad g(x) = 4x$

\+ Add $(f+g)(x) = f(x)+g(x) = \underbrace{x-5}_{f(x)} + \underbrace{+4x}_{g(x)} = \boxed{5x-5}$

− Subtract $(g-f)(x) = g(x) - f(x)$ use $-(\ )$ $= 4x - (x-5)$

$= 4x - x + 5 = 3x+5$

• Multiply $(f \cdot g)(x) = f(x) \cdot g(x) = (x-5)4x = 4x^2 - 20x$

/ divide $\left(\frac{g}{f}\right)(x) = \frac{g(x)}{f(x)} = \frac{4x}{x-5}$

CW #1 $(f+g)(x) = x+5+x-4 = \boxed{2x+1}$

$(f-g)(x) = x+5 - (x-4) = \boxed{9}$

$-x\ +4$

$(f \cdot g)(x) = (x+5)(x-4) = x^2 - 4x + 5x - 20$

$= x^2 + x - 20$

$\left(\frac{f}{g}\right)(x) = \frac{x+5}{x-4}$

Composition of Functions - Part 1

↳ put a function inside a function

Ex: $f(x) = \{(\overset{x}{7},\overset{y}{8}), (5,3), (9,8), (11,4)\}$

$g(x) = \{(5,7), (3,5), (7,9), (9,11)\}$

$f \circ g$	$g \circ f$
"f of g"	"g of f"
put g inside f	put f inside g
$f[\overset{7}{g(5)}] = f(7) = 8$	$g[f(7)] = g(8)$ not defined
$f[\overset{5}{g(3)}] = f(5) = 3$	$g[f(5)] = g(3) = 5$
$f[\overset{9}{\cancel{g(7)}}] = f(9) = 8$	$g[f(9)] = g(8)$ not defined
$f[g(9)] = f(11) = 4$	$g[f(11)] = g(4)$ not defined

→ $f \circ g = \{(5,8), (3,3), (7,8), (9,4)\}$

$g \circ f = \{(5,5)\}$

CW #8 $f = \{(6,6), (-3,-3), (1,3)\}$

$g = \{(-3,6), (3,6), (6,-3)\}$

$f \circ g$ -		$g \circ f$	
$f[g(-3)] = 6$	$(-3,6)$	$g[f(6)] = -3$	$(6,-3)$
$f[g(3)] = 6$	$(3,6)$	$g[f(-3)] = 6$	$(-3,6)$
$f[g(6)] = -3$	$(6,-3)$	$g[f(1)] = 6$	$(1,6)$

Notes - Composition of Functions Pt 2

$f(x) = 3x \qquad g(x) = x^2 + x - 4$

$f \circ g = f[g(x)] = 3(\overbrace{x^2 + x - 4}^{g(x)}) = \boxed{3x^2 + 3x - 12}$ $f \circ g$

$f(2)$

$g \circ f \quad g[f(x)] = (3x)^2 + (3x) - 4$

$3x$

$\boxed{9x^2 + 3x - 4}$ $g \circ f$

$f(x) = 4x \qquad g(x) = 2x - 1$

Find $f[g(-1)] = f(-3) = 4(-3) = -12$

$g(-1) = 2(-1) - 1 = -2 - 1 = -3$

Notes 9/29 – Composition of Functions Pt 3

$g(x) = 2x - 1$ $\quad$ $h(x) = x^2 + 1$ $\quad$ $(-1, 2)$

Ex: $g[h(-1)]$

Find $h(-1)$ first $\quad h(-1) = (-1)^2 + 1$

$h(-1) = 1 + 1 = 2$

$g[2] = 2(2) - 1$

$= 4 - 1 = 3$

$\boxed{g[h(-1)] = 3}$

* Just evaluate twice

Ex 2: $h[g(3)]$ $\quad$ $g(x) = 2x - 1$

$g(3) = 2(3) - 1$

$= 6 - 1 = 5$

$h(5) = 5^2 + 1 = 25 + 1 = \underline{26}$

$h(x) = x^2 + 1$

$h[g(3)] = 26$ $\quad$ $h \circ g = \{(3, 26)$

#